

AMENDMENTS TO THE CLAIMS

Kindly amend the claims as shown in the listing of claims below. This listing of claims will replace all prior versions, and listings of claims in the application.

1-11. (canceled)

12. (Currently Amended) A device comprising:

a solar cell encapsulated with a self-assembled barrier film structure thereon comprised of:

a plurality of layers of an inorganic material; and

a plurality of layers each consisting of an organic polymer wherein the layers of organic polymer alternate with the layers of inorganic material and wherein more than one of layers of the organic polymer contain a superhydrophobic material;

wherein adjacent layers of the organic polymer and the inorganic material are covalently bonded layers characterized by direct organic polymer to inorganic material covalent bonds which form in the self-assembled barrier film structure even with

superhydrophobic material in more than one of the layers of the organic polymer;

wherein random location of pinholes in the layers of the inorganic material and the layers of the organic polymer requires a tortuous pathway marked by repeated turns or bends for any water to pass through the self-assembled barrier film structure, wherein the superhydrophobic material in more than one of the layers of the organic polymer provide surfaces that impede that movement of water between adjacent layers of the organic polymer and the inorganic material.

13. (Previously Amended) The device of claim 12 wherein the total number of layers of organic polymer and layers of inorganic material in the film is between about 100 and about 1000 layers, or between about 1000 and about 10,000 layers, or between about 10,000 layers and about 100,000 layers.

14. (Previously Amended) The device of claim 12 wherein each of the layers of inorganic material has a thickness of about 0.1 nm to about 1 nm; about 1 to about 10 nm; or about 1 nm to about 100 nm.

- 1 15. (Previously Amended) The device of claim 14 wherein the barrier film is substantially
2 transparent.
- 1 16. (Previously Amended) The device of claim 12 wherein the barrier film has a permeability to
2 oxygen less than about 1 cc/m²/day, 0.1 cc/m²/day, 0.01 cc/m²/day, 10⁻³ cc/m²/day, 10⁻⁴
3 cc/m²/day, 10⁻⁵ cc/m²/day, or 10⁻⁶ cc/m²/day.
- 1 17. (Previously Amended) The device of claim 16 wherein the barrier film has a permeability to
2 water vapor less than about 0.01 g/m²/day, 10⁻³ g/m²/day, 10⁻⁴ g/m²/day, 10⁻⁵ g/m²/day, or
3 10⁻⁶ g/m²/day.
- 1 18. (canceled).
- 1 19. (Previously Amended) The device of claim 12 wherein the superhydrophobic material
2 includes fluororalkylsilane.
- 1 20. (Previously Amended) The device of claim 12 wherein the layers of organic polymer are
2 made from polymer precursors to which one or more one or more hydrophobic groups
3 have been added.
- 1 21. (Previously Amended) The device of claim 20 wherein the one or more hydrophobic groups
2 are selected from the group of non-polar hydrophobic groups, methyl groups, benzyl
3 (aromatic) groups, PO₄³⁻, SO₄²⁻, CH₃COO⁻, Cl⁻, Br⁻, NO⁻, ClO₄⁻, I⁻, SC_n⁻ anions, NH₄⁺,
4 Rb⁺, K⁺, Na⁺, Cs⁺, Li⁺, Mg²⁺, Ca²⁺, Ba²⁺ cations, tryptophan, isoleucine, phenylalanine,
5 tyrosine, leucine, valine, methionine, and alanine.
- 1 22. (Previously Amended) The device of claim 12 wherein the barrier film is made from a sol
2 including one or more Gemini surfactants.
- 1 23. (canceled).
- 1 24. (canceled)
- 1 25. (Previously Amended) The device of claim 12 wherein one or more of the layers of organic
2 polymer and/or inorganic material are in the form of lamellae.

26. (Previously Amended) The device of claim 12 wherein one or more of the layers of organic polymer and/or inorganic material are in the form of tubules.

27. (Canceled).

28. (Previously Amended) The device of claim 12 wherein adjacent layers of the organic polymer and inorganic material are covalently bonded to each other at an interface between organic and inorganic materials.

29. (Previously Amended) The device of claim 12 wherein the layers of the organic polymer are discrete layers of organic polymer and wherein the layers of inorganic material are discrete layers of inorganic material.

30. (Previously Amended) The device of claim 12 wherein alternating layers of organic polymer and inorganic material present a long and tortuous penetration path through the barrier film to an underlying substrate.

31. (Previously Amended) The device of claim 12 wherein layers of the inorganic material are self-assembled layers of inorganic material.

32. (Previously Amended) The device of claim 12 wherein layers of the organic polymer are self-assembled layers of organic polymer.

33. (Previously Amended) The device of claim 12 wherein at least one coating of material self-assembles into the alternating plurality of layers of inorganic material and plurality of layers of organic polymer.

34. (Previously Amended) The device of claim 12 wherein layers consisting of the organic polymer and layers of the inorganic material have different material compositions.

35. (Previously Amended) The device of claim 12 wherein the layers of inorganic material are layers consisting of the inorganic material.

36. (previously amended) An inorganic/organic nanolaminate barrier film, comprising:
a self-assembled structure comprised of:
a plurality of layers of an inorganic material; and

a plurality of layers each consisting of an organic polymer wherein the layers of organic polymer alternate with the layers of inorganic material and wherein more than one of layers of the organic polymer contain a superhydrophobic material;
wherein adjacent layers of the organic polymer and the inorganic material are covalently bonded layers characterized by direct organic polymer-inorganic material covalent bonds between adjacent layers which form in the self-assembled structure even with the superhydrophobic material in the one or more layers of the organic polymer;
wherein the layers of the organic polymer contain superhydrophobic material.

37. (Currently Amended) A device comprising:

a photovoltaic device with an inorganic/organic nanolaminate barrier film formed thereon, wherein the self-assembled barrier film comprises:
a plurality of layers of an inorganic material; and
a plurality of layers each consisting of an organic polymer wherein the layers of organic polymer alternate with the layers of inorganic material and wherein more than one of the layers of the organic polymer contain a superhydrophobic material;
wherein adjacent layers of the organic polymer and the inorganic material are covalently bonded layers characterized by direct organic polymer-inorganic material covalent bonds between adjacent layers which form in the self-assembled barrier film even with the superhydrophobic material in the one or more layers of the organic polymer;
wherein the layers of the organic polymer contain superhydrophobic material; wherein a bottom layer of the barrier film in contact with the photovoltaic device is an inorganic layer;
wherein random location of pinholes in the layers of the inorganic material and the layers of the organic polymer requires a tortuous pathway marked by repeated turns or bends for any water to pass through the self-assembled barrier film structure, wherein the superhydrophobic material in more than one of the layers of the organic polymer provide surfaces that impede that movement of water between adjacent layers of the organic polymer and the inorganic material.

38. (previously amended) The barrier film of claim 12 wherein superhydrophobic decreases the permeability of the barrier film while still providing for self-assembly of nanostructures by way of micelle formation and incorporation of polymer precursors into the micellar interiors

4 and the barrier film is at least 1000 nm thick comprised of individual layers, each about 1 nm
5 thick.